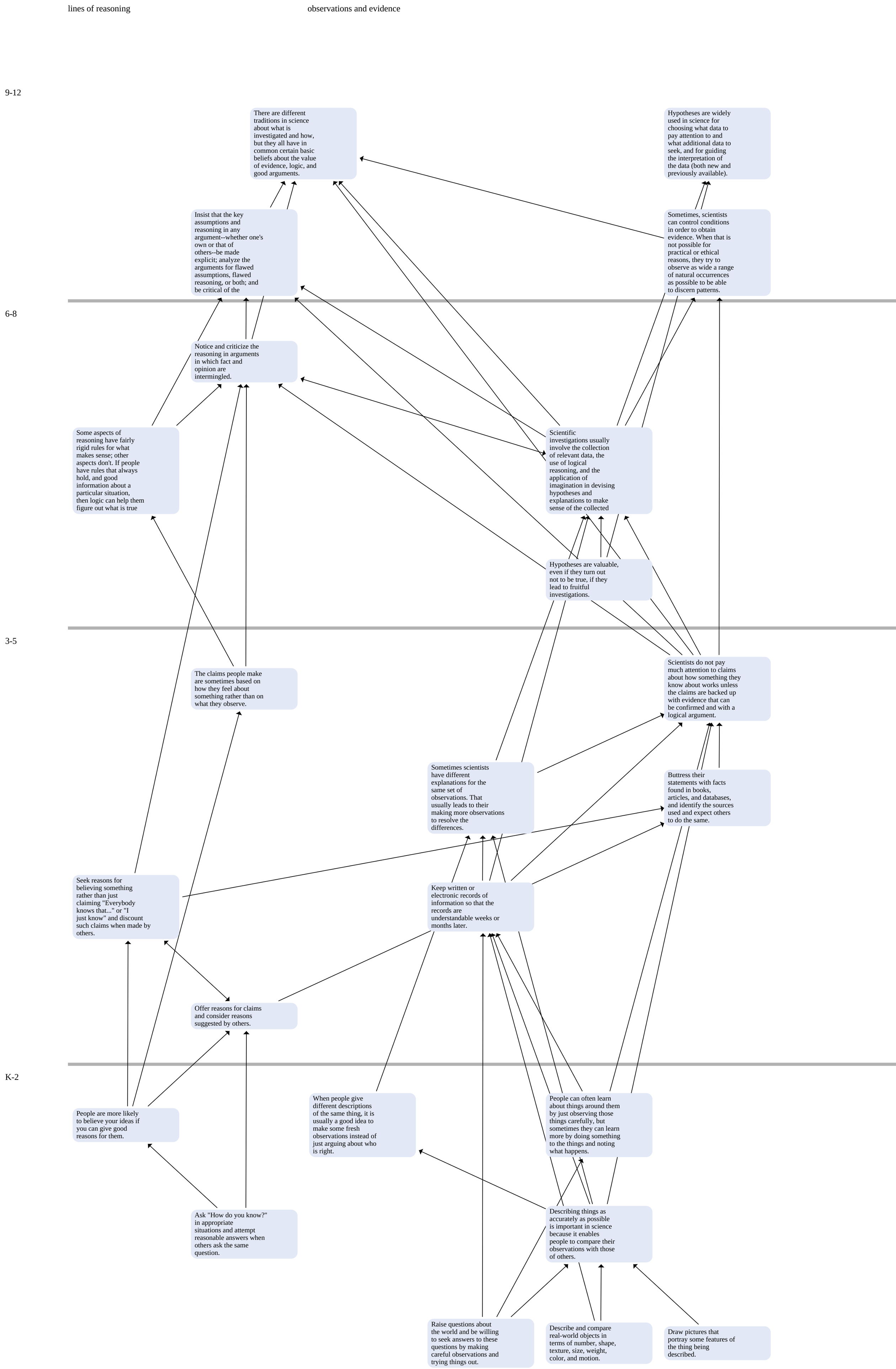
lines of reasoning
observations and evidence
9-12
There are different traditions in science about what is investigated and how, but they all have in common certain basic beliefs about the value of evidence, logic, and good arguments.
Hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available).
Insist that the key assumptions and reasoning in any argument--whether one's own or that of others--be made explicit; analyze the arguments for flawed assumptions, flawed reasoning, or both; and be critical of the
Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns.
6-8
Notice and criticize the reasoning in arguments in which fact and opinion are intermingled.
Some aspects of reasoning have fairly rigid rules for what makes sense; other aspects don't. If people have rules that always hold, and good information about a particular situation, then logic can help them figure out what is true
Scientific investigations usually involve the collection of relevant data, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected
Hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.
3-5
The claims people make are sometimes based on how they feel about something rather than on what they observe.
Scientists do not pay much attention to claims about how something they know about works unless the claims are backed up with evidence that can be confirmed and with a logical argument.
Sometimes scientists have different explanations for the same set of observations. That usually leads to their making more observations to resolve the differences.
Buttress their statements with facts found in books, articles, and databases, and identify the sources used and expect others to do the same.
Seek reasons for believing something rather than just claiming "Everybody knows that..." or "I just know" and discount such claims when made by others.
Keep written or electronic records of information so that the records are understandable weeks or months later.
Offer reasons for claims and consider reasons suggested by others.
K-2
People are more likely to believe your ideas if you can give good reasons for them.
When people give different descriptions of the same thing, it is usually a good idea to make some fresh observations instead of just arguing about who is right.
People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.
Ask "How do you know?" in appropriate situations and attempt reasonable answers when others ask the same question.
Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.
Raise questions about the world and be willing to seek answers to these questions by making careful observations and trying things out.
Describe and compare real-world objects in terms of number, shape, texture, size, weight, color, and motion.
Draw pictures that portray some features of the thing being described.